

Is laparoscopic surgery beneficial and minimally invasive? How does the approach work and where does it lead?

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Abstract

Since the first introduction of laparoscopic cholecystectomy, the field of laparoscopic surgery has expanded rapidly to include surgery for other organs, and more complex and technically demanding abdominal surgery. The reduced invasiveness of laparoscopic surgery is seen clinically in the rapid recovery and return to normal activities that results from reduced patient pain, destruction of the abdominal wall, and damage to organs and peritoneum when exposed to air. However, the exact procedure being performed in the abdominal cavity is sometimes a more important factor affecting the invasiveness of the surgery. Complicated and technically demanding procedures, which often increase the operation time and bleeding, and alter organ function, are sometimes more invasive by their nature, which diminishes the merits of laparoscopic surgery.

For example, laparoscopic liver resections (LLR) under different settings have different results with or without the merits of laparoscopic surgery. In patients with hepatocellular carcinoma with the background chronic liver disease, LLR allows the surgeon to resect the tumor-bearing area with minimal damage to the liver and the surrounding environment, and to lower the risks of postoperative ascites and liver failure. However, these findings apply specifically to this setting and results differ for others.

As indications expand, the true advantages and disadvantages of specific procedures in laparoscopic surgery should be reconsidered depending on the setting of each procedure.

Keywords: laparoscopic surgery, laparoscopic liver resection, indication, hepatocellular carcinoma, chronic liver disease

Laparoscopes were first introduced to diagnose urological and gynecological diseases in the 1960s. The ability to create pneumoperitoneum and the development of the charged-coupled device (CCD) camera, which magnifies and projects laparoscopic images onto television monitors, led to the first laparoscopic cholecystectomy performed with the current approach, in 1987 by Phillipe Mouret of Lyon, France.¹ In this approach, the operator, assistants, and scopist have the same, sometimes magnified, surgical view on the screen and can co-perform the surgery.

Consensus developed quickly following the first cholecystectomy, and resulted in a statement that laparoscopic cholecystectomy was “the treatment of choice for many patients with symptomatic cholelithiasis”.² The procedure was accepted immediately based on the clinical experience of less patient pain, and rapid recovery and return to normal activities, in addition to the cosmetic advantages. However, the popularity of laparoscopic surgery developed rapidly without randomized trials being conducted. Retrospective data show that laparoscopic cholecystectomy is safe and effective. Also, compared with open laparotomy, the advantages of laparoscopic cholecystectomy have been described as, “obvious and compelling”.^{3,6}

Since the first procedures, the field of laparoscopic surgery has expanded rapidly to include surgery for other abdominal organs, such as the colon⁷ and stomach,⁸ and more complex and technically demanding abdominal surgery. For example, the first successful laparoscopic liver resection (LLR) was a wedge resection in 1992.⁹ Although LLR is generally believed to be a

“less invasive” procedure than open liver resection (OLR), as with other laparoscopic surgeries, liver resection for hepatic lesions is performed under a variety of settings. Liver resection styles vary and include partial resection, segmentectomy, sectionectomy, hemihepatectomy, and combinations of these procedures (also with/without vessel resection/reconstruction and lymph node dissection). The disease and the condition of the liver itself are also variables, such as hepatocellular carcinomas in chronically injured fibrous livers with poor functional reserve,^{10,11} and liver metastases with congestion or steatosis of the liver after chemotherapy.¹²

The reduced invasiveness of laparoscopic surgery is seen clinically in the rapid recovery and return to normal activities that results from reduced patient pain, destruction of the abdominal wall, and damage to organs and peritoneum when exposed to air, as seen for laparoscopic cholecystectomy. However, the exact procedure being performed in the abdominal cavity is sometimes a more important factor affecting the invasiveness of the surgery. Complicated and technically demanding procedures, which often increase the operation time and bleeding, and alter organ function, are sometimes more invasive by their nature, which diminishes the merits of laparoscopic surgery.

LLRs under different settings have different results. The summary paper of the 2nd International Consensus Conference on LLR reported that major (three or more segments) LLR remains an innovative procedure, still in the experimental phase, and continued cautious introduction is recommended. This contrasts with minor LLR, which is now standard practice.¹³ Cauchy and colleagues reported that incomplete LLR with conversion to an open procedure is associated with large lesions and biliary reconstruction.¹⁴ Two Japanese multi-institutional studies using propensity score matching obtained different results for LLRs in patients with HCC and

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colorectal liver metastasis. Only HCC patients showed fewer postoperative complications, although LLRs in selected patients with HCC and colorectal liver metastasis both showed similar long-term outcomes and associations with lower blood loss and shorter hospital stay, compared with OLR^{15,16}. HCC develops primarily in injured livers with background chronic liver diseases (CLD). Livers with CLD have poor functional reserve and surrounding portal/lymphatic collateral vessels, which results from fibrous atrophy of the liver and the resulting portal hypertension. Also, all tissues in the CLD liver have the potential for (multicentric) carcinogenesis. Therefore, most HCC patients have a high risk of developing significant postoperative complications and multicentric metachronous lesions, which require repeat treatment.¹⁷ The liver is located and protected inside the costal cage under the diaphragm, and is fixed to the diaphragm and retroperitoneum by peritoneal attachments. To manipulate the liver during OLR, surgeons must open the costal cage with a large subcostal incision, physically pick up the liver and dissect the peritoneal attachments, which involves compressing the parenchyma (Fig 1). These maneuvers destroy the collateral portal/lymphatic flow and damage the liver parenchyma, which leads to postoperative ascites and severe complications with the risk of liver failure.¹⁸ Repeat OLR also requires dissecting postoperative adhesions with the newly-developed collateral vessels, which requires longer operation time, and involves increased bleeding and risks of complications, such as bowel injury. Given these concerns, a laparoscopic approach has specific advantages for liver resection.^{19,20} In LLR, laparoscope and forceps enter a small subphrenic space without a large incision and with minimal dissection of the peritoneal attachments and adhesions (Fig 1). This allows the surgeon to resect the tumor-bearing area with minimal damage to the liver and the surrounding environment, and to lower the risks of postoperative ascites and liver failure. LLR also results in fewer post-operative adhesions; therefore, LLR makes LR easier to repeat in patients with HCC/CLD.²¹ These findings apply specifically to LLR, and results differ for other procedures, depending on the specific setting.

In conclusion, the reduced invasiveness of laparoscopic surgery is seen clinically as rapid recovery and return to normal activities. However, complicated and technically demanding procedures are sometimes invasive regardless of the approach, which diminishes the merits of laparoscopic surgery. As indications expand, the true advantages and disadvantages of specific procedures in laparoscopic surgery should be reconsidered depending on the setting of each procedure.

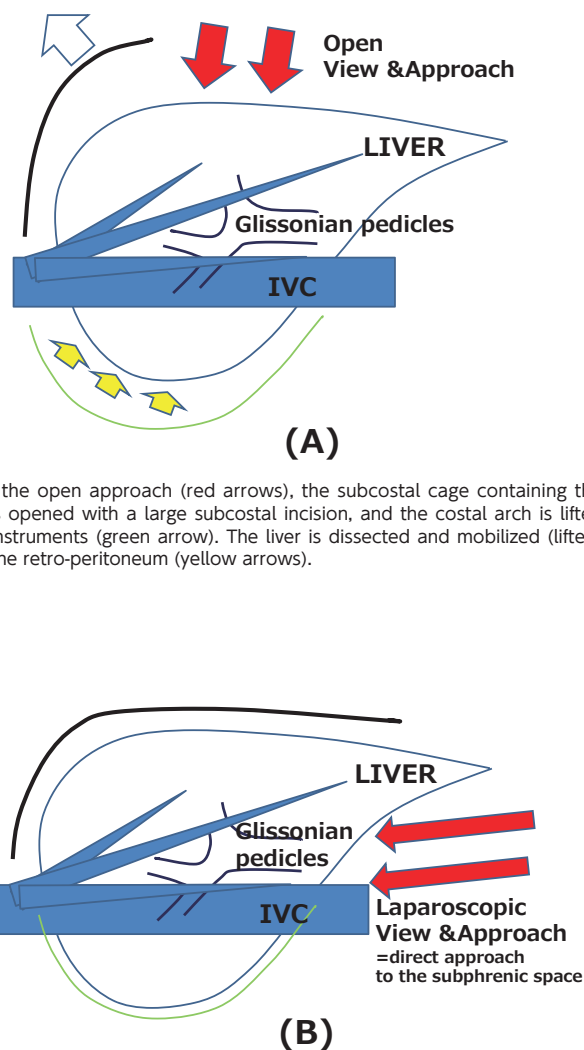
Conflict of interest

The author have no conflict of interest to declare.

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Figure 1. Differences between approaches for open and laparoscopic liver resection.



(A) In the open approach (red arrows) the subcostal cage containing the liver is opened with a large subcostal incision, and the costal arch is lifted with instruments (green arrow). The liver is dissected and mobilized (lifted) from the retro-peritoneum (yellow arrows).

(B) In the laparoscopic approach (red arrows), the laparoscope and forceps enter the subcostal cage, and surgery is performed with minimal alteration and destruction of the associated structures.

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